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School-Based Health Promotion Programmes and the Prevention of Non-Communicable Diseases among Adolescents in Developing Countries

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Abstract: Non-communicable diseases (NCDs) have become a major public health challenge among adolescents in developing countries due to increasing exposure to unhealthy lifestyles and behavioral risk factors. This review examined school-based health promotion programmes and their role in preventing non-communicable diseases among adolescents in developing countries. The study specifically explored major NCD risk factors affecting adolescents, assessed the effectiveness of school-based health promotion interventions, and identified challenges affecting programme implementation and sustainability. A systematic literature review design was adopted using secondary data obtained from peer-reviewed journal articles, institutional reports, and scholarly publications retrieved from major electronic databases. The review included studies published between 2010 and 2026 focusing on adolescents aged 10–19 years within developing countries. Findings from the review revealed that physical inactivity, unhealthy dietary practices, obesity, tobacco use, alcohol consumption, and mental health disorders were the major non- communicable disease risk factors affecting adolescents. The findings further demonstrated that school-based health promotion programmes significantly improved healthy dietary behaviors, increased physical activity participation, reduced substance abuse, and enhanced mental health outcomes among adolescents. Multi-component interventions integrating nutrition education, physical activity promotion, mental health support, and behavioral change communication were found to be more effective than isolated

interventions. However, several barriers including inadequate funding, poor infrastructure, weak policy implementation, insufficient teacher training, shortage of mental health professionals, and socio-cultural challenges negatively affected programme implementation in developing countries. The review concluded that school-based health promotion programmes are essential strategies for preventing non-communicable diseases among adolescents. Strengthening policy support, increasing investment in adolescent health programmes, improving school infrastructure, and promoting intersectoral collaboration are necessary for enhancing programme effectiveness and reducing future NCD burdens among adolescents in developing countries.

Keywords: Adolescents, Non-Communicable Diseases, School-Based Health Promotion, Developing Countries, Prevention

1. INTRODUCTION

Non-communicable diseases (NCDs) such as cardiovascular diseases, diabetes, cancers, chronic respiratory diseases, and mental health disorders have become major global public health concerns, particularly in developing countries. According to the World Health Organization, NCDs account for most global deaths, with many risk factors beginning during adolescence. Adolescence is a critical stage of development where lifelong health behaviors are established, making young people highly vulnerable to unhealthy lifestyles that contribute to chronic diseases later in life (Patton et al., 2016). The growing burden of NCDs among adolescents has been linked to unhealthy diets, physical inactivity, tobacco use, alcohol consumption, sedentary lifestyles, and poor mental health practices. Rapid urbanization, globalization, and technological advancement in developing countries have increased adolescents' exposure to processed foods, sugar-sweetened beverages, and screen-based activities, thereby increasing obesity and metabolic disorders (Abarca-Gómez et al., 2017). Studies also show that insufficient physical activity among adolescents contributes significantly to rising NCD prevalence globally (Guthold et al., 2020).

Mental health challenges such as anxiety, depression, and stress are increasingly affecting adolescents in developing countries due to poverty, academic pressure, and social inequalities. These conditions often encourage unhealthy coping behaviors including substance abuse and poor dietary habits (Viner et al., 2012). Since many NCD-related behaviors begin during adolescence and persist into adulthood, early preventive interventions are essential. Schools are recognized as important settings for health promotion because they provide structured environments where adolescents can be reached consistently. School-based health promotion programmes involve interventions such as nutrition education, physical activity promotion, mental health support, and health education aimed at improving healthy behaviors among students. Evidence suggests that such programmes improve physical activity, healthy eating, and psychological well-being among adolescents (Langford et al., 2015). Despite these benefits, implementation of school-based health programmes in developing countries is often challenged by inadequate funding, poor infrastructure, insufficient teacher training, and weak policy support. Therefore, strengthening school-based health promotion programmes is essential for reducing NCD risk factors among adolescents in developing countries.

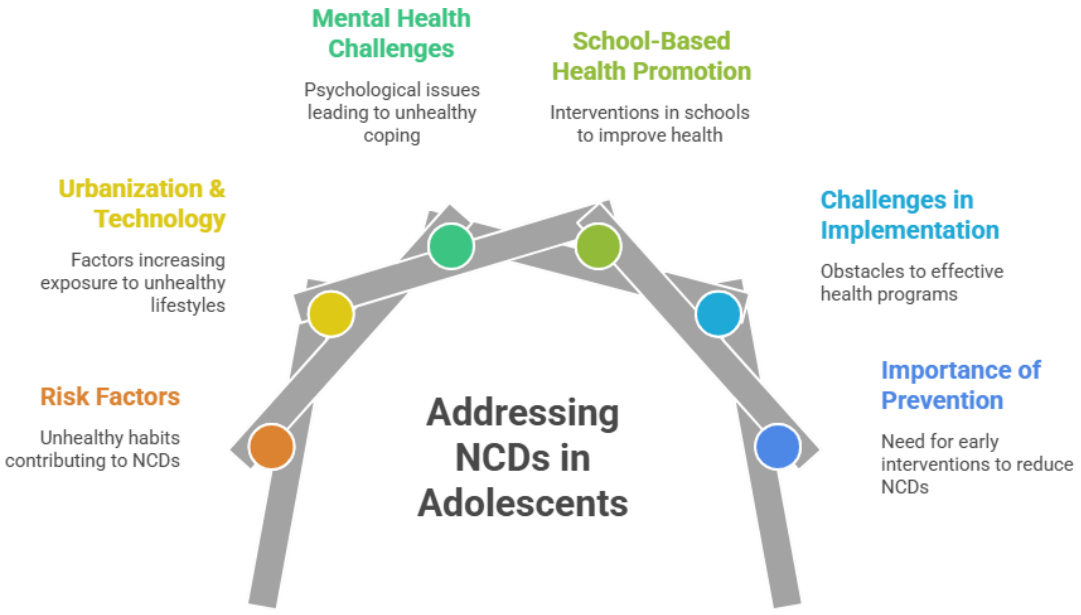


Figure 1: Addressing NCDs in Adolescence

2. RELATED STUDIES

School-based health promotion programmes have increasingly gained global recognition as effective strategies for preventing non-communicable diseases (NCDs) among adolescents. Adolescence represents a critical developmental period during which lifestyle behaviors such as dietary practices, physical activity patterns, substance use, and mental health habits are established and often persist into adulthood. In developing countries, rapid urbanization, changing socioeconomic conditions, and globalization have contributed significantly to increasing adolescent exposure to NCD risk factors. Consequently, schools have become important environments for implementing preventive interventions aimed at promoting healthy behaviors and reducing long-term disease risks. Several empirical studies have examined the effectiveness of school-based interventions in improving adolescent health outcomes, including nutrition, physical activity, mental health, tobacco prevention, and obesity reduction. Existing literature further highlights the importance of comprehensive and multi-component programmes involving students, teachers, parents, and communities.

School-Based Nutrition Promotion Programmes and Prevention of NCDs

Nutrition-related interventions constitute one of the most widely implemented school-based health promotion strategies for preventing non-communicable diseases among adolescents. Poor dietary habits, including excessive intake of processed foods, sugar-sweetened beverages, and high-fat diets, significantly contribute to obesity, diabetes, hypertension, and cardiovascular diseases among young populations. Several studies have demonstrated that school-based nutrition programmes positively influence adolescents' dietary behaviors and overall health outcomes. Langford et al. (2015) found that comprehensive school health programmes significantly improved students' nutritional knowledge and healthy eating behaviors through structured nutrition education and supportive school policies. Similarly, Demaio et al. (2019) reported that nutrition- focused school interventions in low- and middle-income countries increased fruit and vegetable consumption while reducing unhealthy food intake among adolescents. Research conducted by Wang et al. (2015) further demonstrated that school nutrition programmes reduced obesity prevalence among school-aged children through behavioral change education and dietary modifications. In South Africa, Jacobs et al. (2016) observed that integrating nutrition education into school curricula improved students' awareness of healthy dietary practices and reduced consumption of unhealthy snacks. Likewise, Andrade et al. (2020) found that nutrition promotion programmes in Brazilian schools significantly improved adolescent dietary choices and reduced obesity-related risk factors. Studies by Salam et al. (2020) also indicated that multi-component school interventions combining nutrition education, physical activity, and parental involvement produced more sustainable health outcomes than isolated interventions. Despite these positive outcomes, evidence suggests that several barriers continue to undermine the effectiveness of school-based nutrition programmes in developing countries. Muthuri et al. (2014) reported that limited funding, poor school feeding systems, inadequate teacher training, and lack of educational materials often affect programme implementation. Cultural beliefs and socioeconomic inequalities also influence adolescents' dietary behaviors and access to healthy foods.

Physical Activity Promotion and Adolescent Health Outcomes

Physical inactivity remains a major risk factor contributing to the increasing burden of non-communicable diseases among adolescents globally. School-based physical activity programmes have therefore become important interventions for promoting healthy lifestyles and preventing obesity, cardiovascular diseases, and metabolic disorders among young people. Guthold et al. (2020) revealed that more than 80% of adolescents worldwide fail to meet recommended physical activity levels, particularly in developing countries where urbanization and technological advancement have increased sedentary lifestyles. School-based physical education programmes have shown substantial effectiveness in improving adolescent fitness levels and reducing obesity prevalence. Muthuri et al. (2014) found that structured physical activity programmes in African schools improved cardiovascular fitness, body composition, and psychological well-being among adolescents. Similarly, Janssen and LeBlanc (2010) demonstrated that regular physical activity among school-aged children significantly reduced the risk of obesity, hypertension, and diabetes while improving mental health outcomes.

Research conducted by Lubans et al. (2016) also showed that school-based exercise interventions enhanced adolescents' physical fitness, self-esteem, and academic performance. In China, Xu et al. (2021) reported that school physical activity programmes reduced sedentary behavior and improved healthy lifestyle practices among secondary school students. Furthermore, van Sluijs et al. (2021) emphasized that schools provide supportive environments for promoting active lifestyles because adolescents spend substantial amounts of time within educational settings. Multi-component interventions involving sports participation, active breaks, physical education classes, and extracurricular activities were found to produce greater health benefits than single interventions. However, several studies identified barriers affecting programme implementation in developing countries, including inadequate sports facilities, insufficient trained personnel, overcrowded school schedules, and limited government support. Research by Kohl et al. (2012) stressed that promoting physical activity during adolescence is essential for reducing future NCD burdens because inactive adolescents are more likely to become inactive adults.

Mental Health Promotion and Prevention of Behavioral Risk Factors

Mental health promotion has increasingly become an important component of school-based health programmes due to the growing prevalence of psychological disorders among adolescents. Mental health challenges such as anxiety, depression, stress, and emotional distress significantly contribute to unhealthy coping behaviors including substance abuse, poor dietary habits, and physical inactivity. Fazel et al. (2014) reported that school-based mental health interventions in low- and middle-income countries improved emotional resilience, coping skills, and psychological support among adolescents. Similarly, Weare and Nind (2011) found that comprehensive mental health promotion programmes positively influenced students' emotional well-being, social relationships, and academic performance. Research conducted by Patel et al. (2018) further demonstrated that integrating mental health education into school curricula improved awareness and early identification of psychological disorders among adolescents. In Kenya, Ndetei et al. (2016) observed that school counseling programmes significantly reduced stress, anxiety, and depression among secondary school students. Likewise, Barry et al. (2017) found that mental health promotion interventions enhanced self-esteem, emotional regulation, and social competence among adolescents in developing countries. Studies also indicate that positive school environments contribute significantly to improved mental health outcomes and reduced risky behaviors among adolescents. Substance abuse prevention programmes implemented within schools have also shown considerable effectiveness in reducing tobacco and alcohol use among adolescents. Thomas et al. (2015) found that school-based tobacco prevention interventions reduced smoking initiation rates among adolescents through peer education and behavioral change communication. Similarly, Onrust et al. (2016) reported that substance abuse education programmes significantly reduced alcohol and drug experimentation among secondary school students. Despite these achievements, mental health promotion in developing countries continues to face substantial challenges including stigma, inadequate mental health professionals, weak institutional support, and poor integration of mental health services into school systems. Researchers therefore recommend increased investment in adolescent mental health programmes, teacher training, and policy support to strengthen school-based prevention strategies.

3. METHODOLOGY

This chapter presents the methodological procedures used in conducting the review on school-based health promotion programmes and the prevention of non-communicable diseases among adolescents in developing countries. The methodology provides a systematic approach for identifying, selecting, reviewing, and synthesizing relevant scholarly literature related to the study topic. The chapter explains the research design, sources of data, search strategy, inclusion and exclusion criteria, study selection procedures, data extraction processes, methods of data analysis, and ethical considerations guiding the review. The methodological procedures adopted in this study were intended to ensure credibility, reliability, transparency, and scholarly rigor throughout the review process. By applying systematic review procedures, the study was able to critically analyze empirical evidence regarding the effectiveness of school-based health promotion programmes in addressing adolescent non-communicable disease risk factors in developing countries.

Research Design

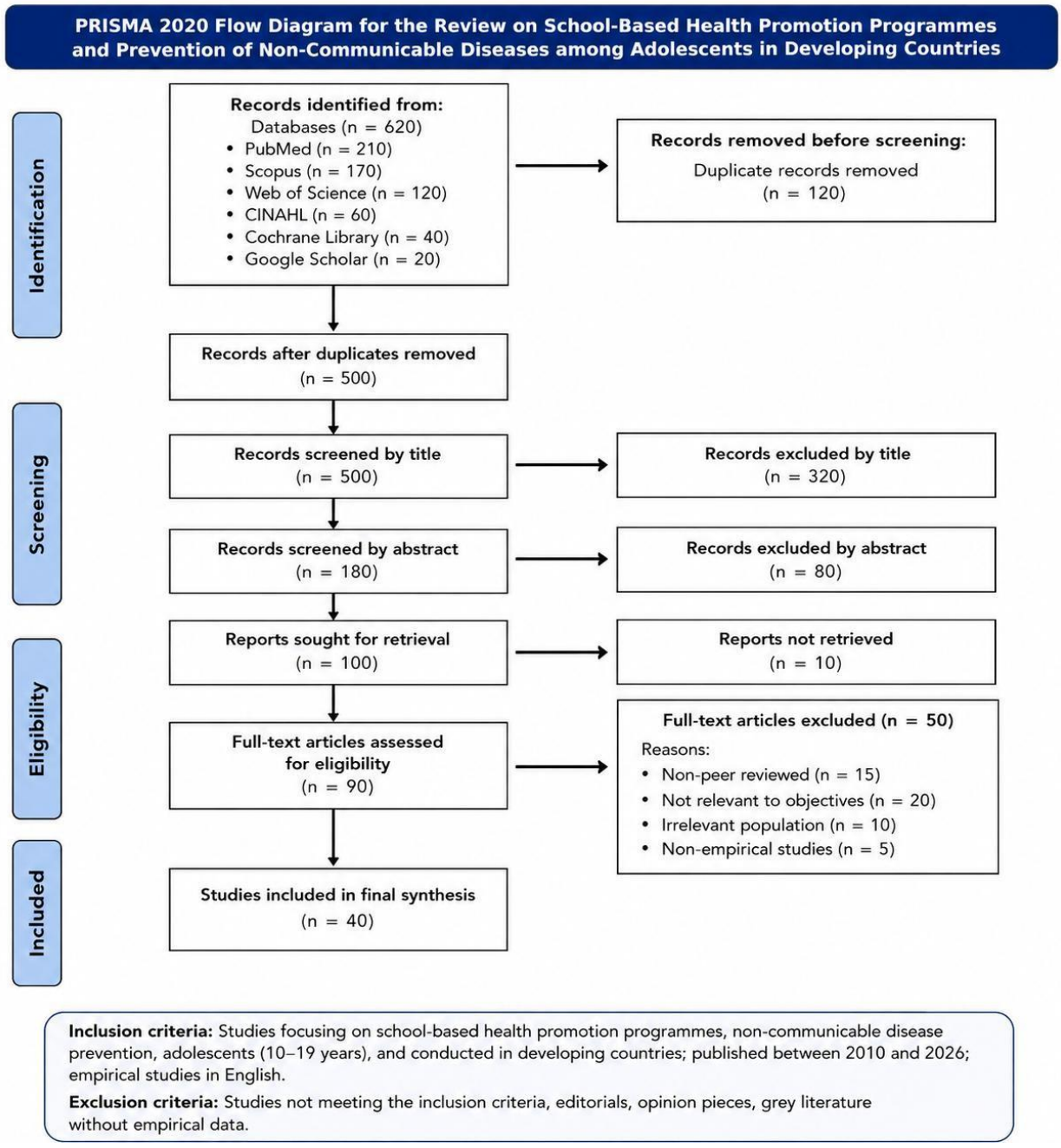
This study adopted a systematic literature review design to examine existing evidence on school- based health promotion programmes and their role in preventing non-communicable diseases among adolescents in developing countries. The systematic review design was considered appropriate because it enables the researcher to gather, critically evaluate, and synthesize findings from multiple empirical studies relating to a particular research problem. The design also provides a comprehensive understanding of existing knowledge, identifies research gaps, and facilitates evidence-based conclusions regarding the effectiveness of school-based interventions in improving adolescent health outcomes. Through the systematic review approach, the study integrated findings from various scholarly publications, institutional reports, and peer-reviewed articles to generate a broader understanding of how school-based health promotion programmes contribute to the prevention of non-communicable diseases among adolescents. The design further ensured transparency and consistency in the selection and analysis of studies included in the review.

Sources of Data

The study relied entirely on secondary sources of data obtained from peer-reviewed journal articles, academic textbooks, conference papers, institutional publications, and reports from international organizations. Relevant literature was retrieved from major electronic databases including PubMed, Scopus, Web of Science, and Google Scholar. Additional information was obtained from publications by the World Health Organization, UNICEF, and other global health institutions involved in adolescent health promotion and non-communicable disease prevention. These databases and institutional repositories were selected because they provide access to credible and high-quality scholarly literature relevant to public health, adolescent health promotion, and school-based interventions. The use of multiple data sources enhanced the comprehensiveness and reliability of the review findings.

Search Strategy

A comprehensive search strategy was employed to identify relevant studies for inclusion in the review. The search process involved the use of keywords, phrases, and Boolean operators to retrieve scholarly articles related to school-based health promotion and prevention of non-communicable diseases among adolescents. Keywords used during the search included “school-based health promotion,” “non-communicable diseases,” “adolescents,” “developing countries,” “physical activity,” “nutrition education,” “mental health promotion,” “obesity prevention,” and “substance abuse prevention.” Boolean operators such as AND and OR were used to combine search terms and broaden the search scope. Examples of search combinations included “school- based health promotion AND adolescents,” “non-communicable diseases AND developing countries,” and “physical activity OR nutrition education.” The search focused on studies published between 2010 and 2026 to ensure that recent and relevant evidence relating to adolescent health promotion programmes was captured. Manual searches of reference lists from selected studies were also conducted to identify additional relevant publications.


PRISMA 2020 Flow Diagram for the Review on School-Based Health Promotion Programmes and Prevention of Non-Communicable Diseases among Adolescents in Developing Countries
Identification
Screening
Eligibility
Included
Records identified from:
Databases (n = 620)
• PubMed (n = 210)
• Scopus (n = 170)
• Web of Science (n = 120)
• CINAHL (n = 60)
• Cochrane Library (n = 40)
• Google Scholar (n = 20)
Records removed before screening:
Duplicate records removed
(n = 120)
Records after duplicates removed
(n = 500)
Records screened by title
(n = 500)
Records excluded by title
(n = 320)
Records screened by abstract
(n = 180)
Records excluded by abstract
(n = 80)
Reports sought for retrieval
(n = 100)
Reports not retrieved
(n = 10)
Full-text articles assessed for eligibility
(n = 90)
Full-text articles excluded (n = 50)
Reasons:
• Non-peer reviewed (n = 15)
• Not relevant to objectives (n = 20)
• Irrelevant population (n = 10)
• Non-empirical studies (n = 5)
Studies included in final synthesis
(n = 40)
Inclusion criteria: Studies focusing on school-based health promotion programmes, non-communicable disease prevention, adolescents (10–19 years), and conducted in developing countries; published between 2010 and 2026; empirical studies in English.
Exclusion criteria: Studies not meeting the inclusion criteria, editorials, opinion pieces, grey literature without empirical data.

Inclusion Criteria

Studies included in the review were selected based on specific eligibility criteria to ensure relevance to the research objectives. The inclusion criteria were as follows:

- Studies focusing on adolescents aged between 10 and 19 years.
- Studies examining school-based health promotion programmes.
- Studies addressing prevention of non-communicable diseases or related risk factors.
- Studies conducted in developing or low- and middle-income countries.
- Peer-reviewed empirical studies, systematic reviews, and meta-analyses.
- Studies published in English language between 2010 and 2026.

These criteria ensured that the selected studies were directly related to adolescent health promotion and prevention of non-communicable diseases within school settings in developing countries.

Exclusion Criteria

Studies that did not meet the objectives of the review were excluded from the analysis. The exclusion criteria included:

- Studies focusing exclusively on communicable diseases.
- Studies involving adults or preschool children only.
- Studies conducted solely in developed countries without relevance to developing countries.
- Editorial articles, opinion papers, and unpublished manuscripts.
- Conference abstracts lacking detailed methodology and findings.
- Duplicate publications retrieved from multiple databases.

The exclusion criteria helped to improve the quality, consistency, and relevance of studies included in the final review.

Study Selection Procedure

The study selection procedure involved several systematic stages to ensure the identification of relevant and high-quality literature. Initially, titles and abstracts of retrieved studies were screened to determine their relevance to the research topic. Articles that appeared relevant based on the title and abstract were subjected to full-text review to confirm their eligibility according to the inclusion and exclusion criteria. Duplicate articles identified from multiple databases were removed during the screening process to avoid repetition. Studies that fully met the eligibility criteria were included in the final review synthesis. The study selection procedure ensured transparency, consistency, and objectivity in the identification of relevant literature relating to school-based health promotion programmes and adolescent non-communicable disease prevention.

Data Extraction Procedure

Data extraction was conducted systematically using a structured approach to obtain relevant information from each selected study. Important information extracted from the studies included the name of the author, year of publication, country of study, research design, study population, type of intervention, sample size, key findings, and recommendations. Additional information regarding programme effectiveness, implementation challenges, and policy implications was also extracted. The data extraction process facilitated comparison of findings

across studies and enabled the identification of recurring themes and patterns related to school-based health promotion programmes and non-communicable disease prevention among adolescents.

Data Analysis and Synthesis

The study employed thematic analysis to synthesize findings obtained from the reviewed literature. Extracted data were carefully examined, categorized, and organized into major thematic areas corresponding to the objectives of the review. Themes identified included nutrition promotion programmes, physical activity interventions, mental health promotion, tobacco and substance abuse prevention, and barriers affecting implementation of school-based health programmes. Findings from different studies were compared and interpreted critically to identify similarities, differences, trends, and research gaps. Narrative synthesis was used to present the findings in a coherent and scholarly manner. The thematic analysis approach enabled the study to provide an in-depth understanding of the effectiveness of school-based health promotion programmes in preventing non-communicable diseases among adolescents in developing countries.

Ethical Considerations

Although the study relied entirely on secondary data from published literature and did not involve direct human participation, ethical principles guiding academic research were strictly observed throughout the review process. Proper acknowledgment of all sources of information was ensured through accurate in-text citations and referencing in accordance with accepted academic standards. The study also maintained honesty, transparency, and objectivity in the interpretation and presentation of findings obtained from reviewed literature. Plagiarism, data falsification, and misrepresentation of authors' original ideas were avoided throughout the study. Ethical adherence ensured the credibility and scholarly integrity of the review findings.

4. RESULTS

Table 1: Major Non-Communicable Disease Risk Factors Affecting Adolescents in Developing Countries

Author(s)	Country/Region	Study Focus	Major Findings	Implications
Guthold et al. (2020)	Global LMICs	Physical inactivity among adolescents	Over 80% of adolescents did not meet recommended physical activity levels	Increased risks of obesity and cardiovascular diseases
Abarca-Gómez et al. (2017)	Multiple Countries	Global obesity trends	Significant rise in overweight and obesity among adolescents	Increased prevalence of diabetes and hypertension
Muthuri et al. (2014)	Sub-Saharan Africa	Sedentary lifestyles	Sedentary behavior was common among	Reduced physical fitness and higher

			school-aged adolescents	metabolic risks
Wang et al. (2015)	China	Childhood obesity	Poor dietary habits contributed significantly to obesity among school children	Increased long-term chronic disease burden
Viner et al. (2012)	Global LMICs	Social determinants of adolescent health	Poverty and inequality influenced unhealthy lifestyle behaviors	Increased exposure to NCD risk factors
Patton et al. (2016)	Global	Adolescent health and wellbeing	Risky behaviors developed during adolescence persisted into adulthood	Higher prevalence of adult non-communicable diseases
Sawyer et al. (2018)	Multiple Countries	Adolescent development	Rapid urbanization increased unhealthy dietary patterns	Increased obesity and cardiovascular risks
Barry et al. (2017)	LMICs	Mental health among adolescents	Anxiety and depression contributed to unhealthy lifestyle behaviors	Increased substance abuse and physical inactivity
Thomas et al. (2015)	Multiple Countries	Tobacco prevention	Smoking initiation remained high among adolescents	Increased respiratory and cardiovascular diseases
Onrust et al. (2016)	Developing Countries	Alcohol and drug use	Early alcohol use was associated with poor mental and physical health outcomes	Increased behavioral and chronic disease risks
Patel et al. (2018)	Global LMICs	Mental health burden	Psychological disorders among adolescents were increasing	Increased emotional and behavioral health problems
Salam et al. (2020)	South Asia	Adolescent lifestyle behaviors	Poor dietary practices and physical inactivity remained widespread	Increased obesity and metabolic disorders

The findings presented in Table 1 demonstrate that adolescents in developing countries are increasingly exposed to multiple behavioral and environmental risk factors associated with non-communicable diseases. One of the most dominant risk factors identified across the reviewed studies was physical inactivity. Guthold et al. (2020) established that a substantial proportion of adolescents globally, particularly those living in low- and middle-income countries, failed to meet the recommended levels of daily physical activity. This trend was strongly associated with

increased sedentary lifestyles resulting from excessive screen time, urbanization, reduced recreational opportunities, and growing dependence on technology. Similarly, Muthuri et al. (2014) observed that adolescents in sub-Saharan Africa were increasingly engaging in sedentary behaviors, thereby increasing their vulnerability to obesity, hypertension, and cardiovascular diseases. These findings suggest that the declining participation in physical exercise among adolescents poses a serious public health concern because inactivity during adolescence often continues into adulthood and contributes significantly to future chronic disease burdens.

The reviewed studies further revealed that unhealthy dietary practices remain a major contributor to the growing burden of non-communicable diseases among adolescents in developing countries. Abarca-Gómez et al. (2017) found substantial increases in overweight and obesity among adolescents globally due to increased consumption of processed foods, sugary beverages, and unhealthy dietary patterns. Wang et al. (2015) similarly reported that poor nutrition behaviors among school-aged children contributed significantly to obesity and metabolic disorders. The increasing availability of fast foods and highly processed meals in urban areas has altered traditional dietary habits and exposed adolescents to unhealthy nutritional choices. These dietary transitions are particularly concerning because obesity during adolescence increases the likelihood of developing diabetes mellitus, hypertension, and cardiovascular diseases later in life.

The studies also demonstrated that psychosocial and mental health factors significantly contribute to adolescent exposure to non-communicable disease risk factors. Barry et al. (2017) and Patel et al. (2018) reported increasing levels of anxiety, depression, emotional stress, and psychological distress among adolescents in low- and middle-income countries. These mental health challenges were linked to unhealthy coping mechanisms including substance abuse, smoking, alcohol consumption, emotional eating, and social withdrawal. Viner et al. (2012) further explained that poverty, social inequality, family instability, and limited access to psychosocial support contribute significantly to adolescent vulnerability to risky health behaviors. Patton et al. (2016) emphasized that many behavioral patterns established during adolescence persist into adulthood, thereby increasing long-term risks of chronic diseases.

Table 2: Effectiveness of School-Based Health Promotion Programmes in Preventing Non-Communicable Diseases

Author(s)	Country	Intervention Type	Study Population	Major Findings	Outcome Achieved
Langford et al. (2015)	Multiple LMICs	Comprehensive school health programme	Secondary school students	Improved healthy eating and physical activity behaviors	Reduced obesity risk

Demaio et al. (2019)	India	Nutrition educatio n	Adolescent s	Increased fruit and vegetable consumption	Improved dietary behavior s
Lubans et al. (2016)	Australia/LMI C evidence	Physical activity intervention	School adolescents	Improved physical fitness and self-esteem	Better mental and physical health
Fazel et al. (2014)	LMICs	Mental health promotion	Secondary school students	Improved emotional resilience and coping skills	Reduced anxiety and stress
Thomas et al. (2015)	Multiple Countries	Tobacco prevention education	Adolescent s	Reduced smoking initiation among students	Lower tobacco use
Onrust et al. (2016)	Developing Countries	Substance abuse prevention	Secondary school student s	Reduced alcohol and drug	Improved behavioral outcomes
				experimentatio n	
Xu et al. (2021)	China	School physical exercise programmes	Adolescent s	Reduced sedentary behavior	Improved physical activity participation
Jacobs et al. (2016)	South Africa	School nutrition intervention	School children	Improved nutrition knowledge	Reduced unhealthy eating habits
Salam et al. (2020)	Pakistan	Multi-component health intervention	Adolescent s	Combined nutrition and physical activity interventions were effective	Sustainable healthy behaviors
Barry et al. (2017)	Developing Countries	School mental health programmes	Adolescent s	Improved emotional regulation and self-esteem	Enhanced psychologica l wellbeing
van Sluijs et al. (2021)	Global	Active school environment	Secondary school students	Increased participation in active lifestyles	Reduced obesity prevalence

Patel et al. (2018)	LMICs	School-based psychological support	Adolescents	Increased awareness of mental health issues	Improved help-seeking behavior

The findings presented in Table 2 indicate that school-based health promotion programmes play a significant role in preventing non-communicable diseases among adolescents in developing countries. The reviewed studies consistently demonstrated that interventions implemented within school environments positively influenced adolescent health behaviors and improved overall wellbeing. Nutrition-focused interventions emerged as particularly effective in promoting healthy dietary practices among adolescents. Langford et al. (2015) found that comprehensive school health programmes improved healthy eating habits and increased awareness regarding proper nutrition among students. Similarly, Demaio et al. (2019) observed that nutrition education interventions significantly increased fruit and vegetable consumption while reducing unhealthy eating behaviors associated with obesity and metabolic disorders. These findings indicate that schools provide favorable environments for promoting positive dietary behaviors because students spend substantial periods of time within educational institutions where health messages can be consistently reinforced.

The findings further revealed that school-based physical activity programmes substantially improved adolescents' physical fitness and reduced sedentary behaviors. Lubans et al. (2016) reported that structured exercise interventions enhanced physical fitness, self-esteem, and psychological wellbeing among adolescents. Likewise, Xu et al. (2021) and van Sluijs et al. (2021) found that active school environments significantly increased participation in physical activities and reduced sedentary lifestyles among students. The effectiveness of these interventions demonstrates the importance of incorporating regular physical education, sports participation, and recreational activities into school systems. Physical activity programmes not only contribute to obesity prevention but also improve cardiovascular health, muscular fitness, emotional wellbeing, and academic performance. The findings therefore suggest that schools can serve as important platforms for promoting lifelong healthy lifestyles among adolescents. Mental health promotion and substance abuse prevention programmes also demonstrated considerable effectiveness in improving adolescent wellbeing and reducing risky behaviors. Fazel et al. (2014) and Barry et al. (2017) found that school-based mental health interventions improved emotional resilience, stress management, and psychological support among adolescents. Furthermore, Thomas et al. (2015) and Onrust et al. (2016) reported that tobacco and substance abuse prevention programmes significantly reduced smoking initiation, alcohol use, and drug experimentation among students. The reviewed studies further emphasized that multi-component interventions integrating nutrition education, physical activity promotion, mental health support, and behavioral change communication produced more sustainable outcomes than isolated interventions.

Table 3: Challenges Affecting Implementation of School-Based Health Promotion Programmes

Author(s)	Country/Region	Identified Challenge	Effect on Programme Implementation	Recommendation
Muthuri et al. (2014)	Sub-Saharan Africa	Inadequate sports facilities	Reduced participation in physical activity programmes	Improve school infrastructure
Salam et al. (2020)	South Asia	Limited funding	Inconsistent programme implementation	Increase government investment
Langford et al. (2015)	Multiple LMICs	Weak policy support	Poor sustainability of interventions	Strengthen policy enforcement
Fazel et al. (2014)	LMICs	Lack of mental health professionals	Limited psychological support services	Increase trained counselors
Jacobs et al. (2016)	South Africa	Poor nutrition resources	Inadequate dietary interventions	Improve school feeding systems
Barry et al. (2017)	Developing Countries	Mental health stigma	Reduced utilization of counselling services	Increase awareness campaigns
Thomas et al. (2015)	Multiple Countries	Peer pressure	Increased smoking initiation among adolescents	Strengthen peer education programmes
Patel et al. (2018)	Global LMICs	Poor integration of mental health services	Weak programme coordination	Enhance intersectoral collaboration
Onrust et al. (2016)	Developing Countries	Substance abuse normalization	Increased adolescent alcohol use	Improve behavioral education
Xu et al. (2021)	China	Academic workload	Reduced time for physical activities	Balance academics and recreation
van Sluijs et al. (2021)	Global	Sedentary digital lifestyles	Reduced active participation	Promote active school policies
Demaio et al. (2019)	India	Insufficient teacher training	Weak programme delivery	Train school health educators

The findings presented in Table 3 reveal that despite the effectiveness of school-based health

promotion programmes, numerous barriers continue to affect their implementation and sustainability in developing countries. One of the major challenges identified across the reviewed studies was inadequate funding and poor infrastructure. Salam et al. (2020) reported that limited financial resources significantly affected the implementation of school-based health interventions, particularly in low-resource settings where schools often struggle to provide basic educational materials and health facilities. Similarly, Muthuri et al. (2014) observed that inadequate sports facilities and lack of recreational infrastructure limited adolescents' participation in physical activity programmes. Poor school infrastructure reduces the ability of educational institutions to implement effective health promotion activities and compromises the quality of interventions provided to students. These findings suggest that increased investment in school health infrastructure and programme funding is necessary to improve adolescent health outcomes in developing countries.

The studies also highlighted institutional and policy-related barriers affecting programme effectiveness. Langford et al. (2015) found that weak policy implementation and insufficient government support undermined the sustainability of school-based health programmes in many developing countries. In addition, Demaio et al. (2019) observed that inadequate teacher training reduced the quality of programme delivery because many educators lacked sufficient knowledge and skills in adolescent health promotion. Fazel et al. (2014) and Patel et al. (2018) further reported that many schools lacked trained mental health professionals and counseling services, thereby limiting support for adolescents experiencing psychological distress. Weak coordination between educational and health sectors also contributed to poor programme implementation and reduced sustainability of interventions. These findings indicate that successful implementation of school- based health programmes requires stronger institutional support, improved policy enforcement, and continuous capacity building for teachers and health personnel.

Socio-cultural and behavioral barriers also emerged as important factors influencing adolescent participation in school-based health promotion programmes. Barry et al. (2017) found that mental health stigma prevented many adolescents from seeking counseling and psychological support services within schools. Similarly, Thomas et al. (2015) and Onrust et al. (2016) identified peer pressure and normalization of unhealthy behaviors such as smoking and alcohol use as major obstacles affecting adolescent behavioral change. In many developing countries, cultural beliefs, social norms, and family environments strongly influence adolescents' health behaviors and attitudes toward health promotion interventions. Xu et al. (2021) additionally reported that excessive academic workloads reduced the time available for physical activity participation among students. The findings demonstrate that addressing the challenges affecting school-based health promotion programmes requires comprehensive approaches involving government commitment, community participation, policy strengthening, teacher training, parental involvement, and culturally appropriate intervention strategies.

5. DISCUSSION

This chapter discusses the findings of the review on school-based health promotion programmes and the prevention of non-communicable diseases among adolescents in

developing countries. The discussion is organized according to the objectives of the study and relates the findings to existing empirical literature and theoretical perspectives on adolescent health promotion. The chapter critically examines how school-based interventions influence adolescent health behaviors, reduce exposure to non-communicable disease risk factors, and address challenges affecting programme implementation in developing countries.

Non-Communicable Disease Risk Factors Affecting Adolescents in Developing Countries

The findings of the review revealed that adolescents in developing countries are increasingly exposed to several non-communicable disease risk factors, including physical inactivity, unhealthy dietary practices, obesity, tobacco use, alcohol consumption, and poor mental health conditions. Physical inactivity emerged as one of the most common behavioral risk factors affecting adolescents. This finding is consistent with Guthold et al. (2020), who reported that more than 80% of adolescents globally do not achieve recommended levels of physical activity. The increasing dependence on digital technologies, urbanization, academic pressures, and reduced participation in outdoor recreational activities have significantly contributed to sedentary lifestyles among adolescents. Similarly, Muthuri et al. (2014) found that school-aged children in sub- Saharan Africa increasingly engage in sedentary behaviors due to limited recreational opportunities and changing urban lifestyles. The review further established that unhealthy dietary behaviors remain significant contributors to the growing burden of non-communicable diseases among adolescents in developing countries. Increased consumption of processed foods, sugary beverages, and unhealthy snacks was associated with rising obesity and metabolic disorders among school-aged children. This finding aligns with Abarca-Gómez et al. (2017), who documented increasing trends in overweight and obesity among adolescents globally. Wang et al. (2015) similarly found that unhealthy dietary patterns significantly contributed to childhood obesity and future chronic disease risks. Rapid urbanization and globalization have altered traditional dietary habits in many developing countries, thereby exposing adolescents to unhealthy nutritional choices. These findings demonstrate that poor dietary practices established during adolescence often persist into adulthood and increase vulnerability to chronic diseases such as diabetes mellitus and cardiovascular disorders. Mental health challenges also emerged as important contributors to adolescent non-communicable disease risks. The findings revealed increasing prevalence of anxiety, depression, emotional stress, and psychological distress among adolescents in developing countries. This finding corroborates the work of Patel et al. (2018), who argued that mental health disorders among adolescents are rising rapidly in low- and middle-income countries due to poverty, social inequality, family instability, and limited access to mental health services. Barry et al. (2017) further noted that psychological distress often contributes to unhealthy coping behaviors such as smoking, alcohol consumption, emotional eating, and substance abuse.

Effectiveness of School-Based Health Promotion Programmes

The findings of the review demonstrated that school-based health promotion programmes significantly contribute to the prevention of non-communicable diseases among adolescents. Nutrition education interventions were found to improve healthy eating behaviors and increase adolescents' awareness of proper dietary practices. This finding supports Langford et al. (2015),

who observed that comprehensive school health programmes positively influenced students' nutritional knowledge and healthy dietary choices. Similarly, Demaio et al. (2019) found that school-based nutrition interventions increased fruit and vegetable consumption while reducing unhealthy food intake among adolescents in low- and middle-income countries. The school environment provides a strategic setting where healthy dietary messages can be reinforced consistently through classroom teaching, school feeding programmes, and supportive school policies. The review further established that physical activity promotion programmes implemented in schools significantly improved adolescents' fitness levels and reduced sedentary behaviors. Lubans et al. (2016) reported that structured physical activity interventions enhanced physical fitness, self-esteem, and emotional wellbeing among adolescents. Similarly, van Sluijs et al. (2021) found that active school environments and organized sports participation improved physical activity engagement among students. The findings further align with Janssen and LeBlanc (2010), who concluded that regular physical activity among school-aged children reduces the risks of obesity, hypertension, and cardiovascular diseases. The positive outcomes associated with school-based physical activity programmes demonstrate the importance of schools as supportive environments for promoting active lifestyles and preventing future chronic disease burdens among adolescents. Mental health promotion programmes were also found to contribute positively to adolescent wellbeing and behavioral outcomes. The review indicated that school-based mental health interventions improved emotional resilience, stress management, coping skills, and psychological support among students. This finding agrees with Fazel et al. (2014), who reported that mental health interventions implemented in schools significantly improved emotional wellbeing among adolescents in low- and middle-income countries. Weare and Nind (2011) similarly found that school mental health promotion programmes enhanced social relationships, academic performance, and emotional regulation among students. In addition, tobacco and substance abuse prevention programmes reduced smoking initiation and alcohol experimentation among adolescents. Thomas et al. (2015) found that school-based tobacco prevention interventions significantly reduced smoking behaviors among adolescents through behavioral education and peer support strategies.

Challenges Affecting Implementation of School-Based Health Promotion Programmes Despite the positive outcomes associated with school-based health promotion programmes, the review identified several challenges affecting their implementation and sustainability in developing countries. One of the major barriers identified was inadequate funding and poor infrastructure. The findings showed that many schools lacked adequate sports facilities, health education materials, and financial resources necessary for effective programme implementation. This finding is consistent with Salam et al. (2020), who argued that limited financial investment significantly affects the sustainability of adolescent health promotion interventions in low-resource settings. Similarly, Muthuri et al. (2014) reported that inadequate recreational infrastructure in schools reduced opportunities for physical activity participation among adolescents. The lack of supportive infrastructure compromises the quality and effectiveness of school-based health interventions and limits adolescents' access to healthy environments. The findings also revealed that weak policy implementation and insufficient teacher training negatively affected programme delivery in many developing countries.

Langford et al. (2015) emphasized that effective school health promotion requires strong institutional support, policy enforcement, and integration of health programmes into educational systems. However, many schools lack adequately trained personnel to implement health promotion activities effectively. Demaio et al. (2019) similarly observed that insufficient teacher knowledge and limited training in health education undermine programme effectiveness. In addition, the review found that schools often lacked mental health professionals and counseling services to support adolescents experiencing psychological distress. Fazel et al. (2014) argued that shortages of mental health specialists in developing countries continue to limit access to school-based psychological support services.

Socio-cultural barriers also emerged as important challenges affecting adolescent participation in health promotion programmes. The findings indicated that stigma associated with mental health services, peer pressure, cultural beliefs, and normalization of unhealthy behaviors such as smoking and alcohol use often reduce the effectiveness of school-based interventions. Barry et al. (2017) found that stigma surrounding mental health prevents many adolescents from seeking psychological support within school settings. Similarly, Thomas et al. (2015) reported that peer influence significantly contributes to smoking initiation among adolescents despite health education efforts. These findings suggest that effective school-based health promotion requires collaborative approaches involving families, communities, policymakers, and educational institutions. Addressing socio-cultural barriers, strengthening policies, improving infrastructure, and increasing investment in adolescent health programmes are essential for improving the effectiveness and sustainability of school-based interventions in developing countries.

6. CONCLUSION

The review concluded that non-communicable diseases among adolescents have become a growing public health concern in developing countries due to increasing exposure to unhealthy dietary practices, physical inactivity, substance abuse, obesity, and mental health challenges. The findings revealed that many of these behavioral risk factors are established during adolescence and often persist into adulthood, thereby increasing the future burden of chronic diseases such as cardiovascular diseases, diabetes, hypertension, and mental health disorders. Rapid urbanization, technological advancement, changing lifestyles, and socioeconomic inequalities have further intensified adolescents' vulnerability to unhealthy behaviors in many low- and middle-income countries. The review further established that school-based health promotion programmes are effective strategies for reducing adolescents' exposure to non-communicable disease risk factors. Nutrition education programmes improved healthy dietary behaviors and increased awareness regarding proper nutrition among students. Physical activity interventions significantly enhanced fitness levels, reduced sedentary lifestyles, and contributed to obesity prevention. Mental health promotion programmes also improved emotional wellbeing, stress management, and psychological resilience among adolescents. In addition, school-based substance abuse prevention interventions contributed to reduced tobacco use, alcohol consumption, and other risky behaviors among students. The findings therefore demonstrate that schools provide important environments for implementing comprehensive health promotion interventions capable of improving adolescent health

outcomes. Despite the effectiveness of these programmes, the review identified several challenges affecting implementation and sustainability in developing countries. Inadequate funding, poor infrastructure, weak policy implementation, insufficient teacher training, shortage of mental health professionals, and socio-cultural barriers continue to undermine the success of school-based health promotion interventions. Limited government investment and weak collaboration between health and educational sectors further reduce the effectiveness of adolescent health programmes in many developing countries. The review concludes that strengthening school-based health promotion programmes is essential for preventing non-communicable diseases among adolescents in developing countries. Comprehensive interventions that integrate nutrition education, physical activity promotion, mental health support, and substance abuse prevention can significantly improve adolescent health behaviors and reduce future chronic disease burdens. Sustained government commitment, policy support, intersectoral collaboration, community participation, and increased investment in adolescent health promotion are necessary to ensure the long-term effectiveness and sustainability of school-based interventions.

7. RECOMMENDATION

Governments and educational authorities in developing countries should strengthen school-based health promotion policies and allocate adequate financial resources toward adolescent health programmes. Schools should integrate comprehensive health education into their curricula, focusing on nutrition, physical activity, mental health promotion, and substance abuse prevention. There is also a need to improve school infrastructure by providing adequate sports and recreational facilities that encourage active lifestyles among adolescents. Teachers and school health personnel should receive continuous training to enhance their capacity in delivering effective health promotion interventions. Collaboration between ministries of health, education, families, and community organizations should be strengthened to ensure coordinated implementation of adolescent health programmes. Mental health services and counseling support should also be expanded within schools to address the growing psychological challenges affecting adolescents. Furthermore, culturally sensitive and sustainable interventions should be prioritized to ensure long-term behavioral change and effective prevention of non-communicable diseases among adolescents in developing countries.

8. CONTRIBUTION TO KNOWLEDGE

This review contributes significantly to existing knowledge on school-based health promotion programmes and the prevention of non-communicable diseases among adolescents in developing countries by providing a comprehensive synthesis of current empirical evidence relating to adolescent health promotion interventions. The study expands scholarly understanding of the growing burden of non-communicable diseases among adolescents and highlights how behavioral risk factors such as physical inactivity, unhealthy dietary practices, substance abuse, obesity, and poor mental health are increasingly affecting young populations in developing countries. By integrating findings from diverse empirical studies conducted across low- and middle-income countries, the review provides a broader understanding of the multidimensional nature of adolescent health challenges and the need for comprehensive

preventive strategies. The study further contributes to knowledge by demonstrating the effectiveness of school-based health promotion programmes in improving adolescent health outcomes. The findings provide evidence that nutrition education, physical activity promotion, mental health interventions, and substance abuse prevention programmes implemented within schools significantly reduce exposure to non-communicable disease risk factors. The review therefore strengthens existing literature supporting schools as strategic environments for promoting healthy behaviors among adolescents. In addition, the study contributes theoretically by emphasizing the importance of comprehensive and multi- component interventions that integrate physical, psychological, behavioral, and social dimensions of adolescent health promotion.

Another important contribution of this study lies in its identification of the major barriers affecting implementation and sustainability of school-based health promotion programmes in developing countries. The review highlights challenges such as inadequate funding, poor infrastructure, weak policy implementation, insufficient teacher training, mental health stigma, and socio-cultural influences that undermine programme effectiveness. By identifying these barriers, the study provides practical insights for policymakers, educators, public health professionals, and development partners regarding areas requiring intervention and investment. Finally, the study contributes to policy and practice by providing evidence-based recommendations for strengthening adolescent health promotion in developing countries. The findings underscore the need for stronger government commitment, intersectoral collaboration, community participation, and culturally appropriate interventions to improve adolescent health outcomes and reduce future non- communicable disease burdens.

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